



04-05-02

1632

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Re Application of:

Piunno et al.

Group: 1632

Serial No. 09/993,303

Examiner: Unassigned

Filed: November 21, 2001

Confirmation No.: 5364

For: "SELECTIVITY OF NUCLEIC ACID DIAGNOSTIC AND MICROARRAY TECHNOLOGIES BY CONTROL OF INTERFACIAL NUCLEIC ACID FILM CHEMISTRY"

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INFORMATION DISCLOSURE STATEMENT

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Sir:

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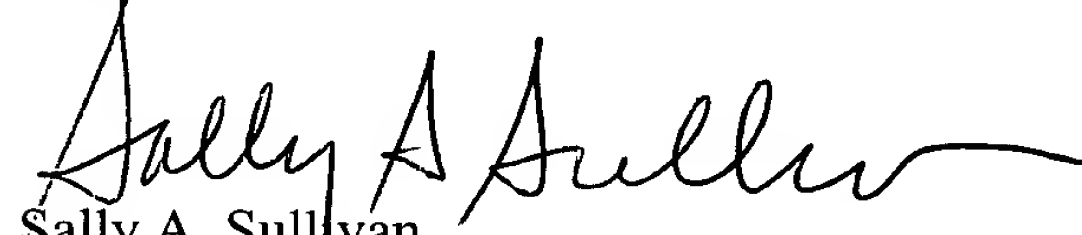
The Examiner is respectfully requested to consider the references, copies enclosed, which may qualify as prior art. For the Examiner's convenience, the references are listed on the attached Patent and Trademark Office Form PTO-1449.

The references and information provided herewith are cited in a spirit of forthrightness and cooperation to enable Applicants to obtain that measure of protection for the invention to which there is entitlement. However, no representation is made that the listed art actually qualifies as prior art under the patent statute and the mere use of PTO-1449 is not an admission that all listed references are prior art. No representation is made that Applicants know of the best art.

References listed in the PTO Form 1449 submitted herewith which do not specify the month of publication have a year of publication sufficiently earlier than the effective US filing date and any foreign priority date so that the particular month of publication is not in issue.

It is believed that this submission does not require the payment of any fees. If this is incorrect, however, please charge any requisite fees to Deposit Account No. 07-1969.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Sally A. Sullivan", with a long horizontal flourish extending to the right.

Sally A. Sullivan  
Reg. No. 32,064

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Attorney docket No. 99-00  
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## U.S. PATENT DOCUMENTS

Exmr. Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
		4,582,809	04/15/86	Block et al.	436	527	
		4,671,938	06/09/87	Cook	422	57	
		5,001,051	03/19/91	Miller et al.	435	6	
		5,135,717	08/04/92	Renzoni et al.	422	61	
		5,156,810	10/20/92	Ribi	422	82.01	
		5,175,209	12/29/92	Beattie et al.	525	54.11	
		5,242,797	09/07/93	Hirschfeld	435	6	
		5,485,277	01/16/96	Foster	356	445	
		5,494,798	02/27/96	Gerdt et al.	435	6	
		5,684,143	11/04/97	Gryaznov et al.	536	23.1	
		5,690,894	11/25/97	Pinkel et al.	422	68.1	
		5,822,073	10/13/98	Yee et al.	356	445	
		5,830,645	11/03/98	Pinkel et al.	435	6	
		5,837,196	11/17/98	Pinkel et al.	422	55	
		6,146,593	11/14/00	Pinkel et al.	422	68.1	
		6,060,237	05/09/00	Nygren et al.	435	6	

## FOREIGN PATENT DOCUMENTS

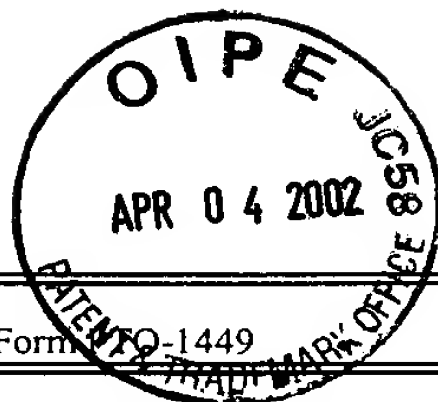
		Document Number	Date	Country	Class	Subclass	Translation Yes/No
		WO 91/05261	04/18/91	WO	G019 33/543	C12Q	
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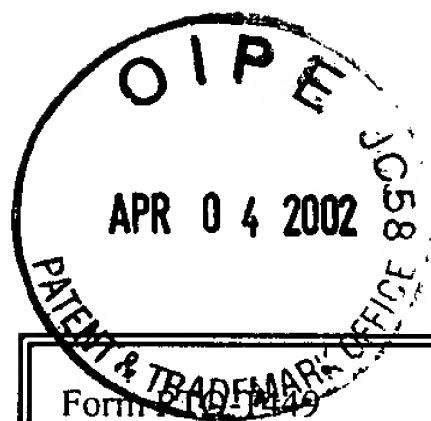


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ATTY DOCKET NO. 99-00	SERIAL NO. 09/993,303	FILING DATE November 21, 2001
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		WO 93/10266	05/27/93	WO	C12Q 1/68	C12M 1/34	
		WO 93/20240	10/14/93	WO	C12Q 1/68	C12N 9/12	
		WO 95/26416	10/05/95	WO	C12Q 1/68	G01N 21/64	
		WO 96/26432	08/29/96	WO	G01N 21/64	33/532	
		WO 98/58079	12/23/98	WO	C12Q 1/68	G01N 21/77	
		WO 00/04390	01/27/00	WO	G01N 33/543	C12Q 1/68	
		EP 0 070687	01/26/83	EP	G01N 33/58		
		EP 0 245 206	11/11/87	EP	C12Q 1/68	G01N 21/75	
		EP 0 478 319	01/04/92	EP	C12Q 1/68		
		EP 0 519 623	12/23/92	EP	G01N 21/64		

## OTHER PRIOR ART (including Author, Title, Date, Pertinent Pages, etc.)

		Abel, A.P. et al., "Fiber-Optic Evanescent Wave Biosensor for the Detection of Oligonucleotides" (1996) <i>Anal. Chem.</i> 68:2905-2912
		Bauer, G.J. et al., "Traveling waves of <i>in vitro</i> evolving RNA"(October 1989) <i>Proc. Natl. Acad. Sci. USA</i> 86:7937-7941
		Beaucage, S.L. and Iyer, R.P., "Advances in the Synthesis of Oligonucleotides by the Phosphoramidite Approach" (1992) <i>Tetrahedron</i> 48(12):2223-2311
		Beier, M. and Hoheisel, J. D., "Versatile derivatisation of solid support media for covalent bonding on DNA-microchips"(May 1999) <i>Nucleic Acids Research</i> 27(9):1970-1977
		Blonder, R. et al., "Application of Redox Enzymes for Probing the Antigen-Antibody Association at Monolayer Interfaces: Development of Amperometric Immunosensor Electrodes" (1996) <i>Anal. Chem.</i> 68:3151-3157
		Bresaluer, K.J., "Extracting Thermodynamic Data From Equilibrium Melting Curves for Oligonucleotide Order-Disorder Transitions" (1994) <i>Methods in Molecular Biology</i> S. Agrawal, Ed. Humana Press N.J. Chapter 14, p347
		Burger, D.R., "Novel Antisense Technology: Therapeutic and Diagnostic Applications" (1993) <i>J. Clinical Immunoassay</i> 16:224-230



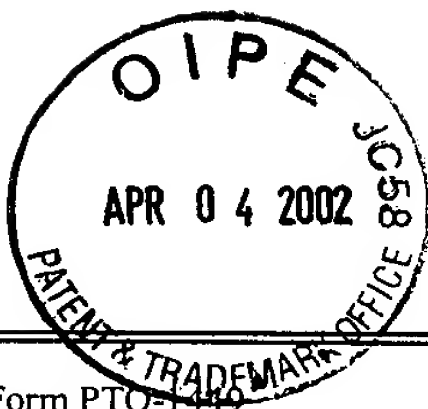
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ATTY DOCKET NO. 99-00		SERIAL NO. 09/993,303	FILING DATE November 21, 2001
APPLICANT Piunno		GROUP 1632	

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RECEIVED

		Caruso, F. et al., "Quartz Crystal Microbalance Study of DNA Immobilization and Hybridization for Nucleic Acid Sensor Development" (1997) Anal.Chem.69:2043-2049
		Chalikian, T.V. et al., "A more unified picture for the thermodynamics of nucleic acid duplex melting: A characterization by calorimetric and volumetric techniques" (July 1999) Proc. Nat'l Acad. Sci. USA 96:7853-7858
		Chan, V. et al., "The Biophysics of DNA Hybridization with Immobilized Oligonucleotide Probes"(December 1995) Biophysical Journal 69:2243-2255
		Charreyre, M.T. et al., (1997) "Fluorescence energy transfer study of the conformation of Oligonucleotides covalently bound to polystyrene latex particles" (1997) Langmuir 13(12):3103-3110
		Chee, M. et al., "Accessing Genetic Information with High-Density DNA Arrays" (October 1996) Science 274:610-614
		Downs, M.E.A., "New DNA technology and the DNA biosensor" (1987) Analytical Letts. 20(12):1897-1927
		Downs, M.E.A., "Prospects for nucleic acid biosensors" (1991) Biochem. Soc. Trans. 19(1):39-43
		Englisch, U. et al., "Chemically Modified Oligonucleotides as Probes and Inhibitors " (June 1991) Angew. Chem. Int. Ed. Eng. 30(6):613-722
		Fang, X. et al., "Designing a Novel Molecular Beacon for Surface-Immobilized DNA Hybridization Studies" (March 11, 1999) 121(12):2921-2922
		Foder, S.P.A. et al., "Light-Directed, Spatially Addressable Parallel Chemical Synthesis" (February 15, 1991) Science 251:767-773
		Fotin, A.V. et al., "Parallel thermodynamic analysis of duplexes on oligodeoxyribonucleotide microchips" (1998) Nucleic Acids Res.. 26(6):1515-1521
		Goodchild, John., "Conjugates of Oligonucleotides and Modified Oligonucleotides: A Review of Their Synthesis and Properties" (May-June 1990) J. Bioconjugate Chem. 1:165
		Graham, C.R. et al., "Gene probe assays on a fibre-optic evanescent wave biosensor" Biosensors & Bioelectronics (1992) 7:487-493
		Granzow, R. and Reed, R., "Interactions in the Fourth Dimension" (April 1992) Biotechnology 10:390-393
		Hahnenberger, K.M., "Rapid detection of infectious agents with a biosensor-based nucleic acid hybridization assay," Final Report (Dec 18, 1992) Contract No. N00014-91-C-0279 NTIS (ADA 259 050)



Form PTO-1449		
ATTY DOCKET NO. 99-00	SERIAL NO. 09/993,303	FILING DATE November 21, 2001
APPLICANT Piunno		GROUP 1632

		Henke, L. et al., "Covalent immobilization of single-stranded DNA onto optical fibers using various linkers" (1997) Anal. Chim. Acta 344:201-213
		Herne, T.M. and Tarlov, M.J., "Characterization of DNA probes immobilized on gold surfaces" (1997) J. Am. Chem. Soc. 119:8916-8920
		Huang, E. et al., "Surface Structure and Coverage of an Oligonucleotide Probe Tethered onto a Gold Substrate and Its Hybridization Efficiency for a Polynucleotide Target" (January 18, 2001) Langmuir 17(4):1215-1224
		Jakeway, S. et al., "Development of a long-chain alkyl tether for immobilization of Oligonucleotides for use in an optical DNA biosensor," 44 <sup>th</sup> Int'l Conf. on Analytical Sciences and Spectroscopy, August 11, 1998, Abstract #49, Kingston, Ontario, Canada
		Jenkins, Y. and Barton, J.K., "A sequence-specific molecular light switch: tethering of an oligonucleotide to a dipyrrophenazine complex of ruthenium(II)" (1992) J. Am. Chem. Soc. 114:8736-8738
		Kleijnung, F. et al., "Fibre-optic genosensor for specific determination of femtomolar DNA oligomers" (September 1997) Anal. Chim. Acta 35:51-58
		Konig, B. and Gratzel, M., "A Piezoelectric Immunosensor for hepatitis viruses" (1995) Anal. Chim. Acta 309:19-25
		Krull, U.J. et al., "Towards a Fiber-Optic DNA Biosensor for Detection of E. Coli," NATO ARW, Smolenice 1997, pp. 25-26
		Krull, U.J. et al., "Fiber Optic DNA Sensor for Fluorimetric Nucleic Acid Analysis," 41 <sup>st</sup> Intl. Conf. on Analytical Sciences and Spectroscopy, (August 14-16, 1995)
		Krull, U.J. et al., "A fiber optic DNA sensor for rapid detection of environmental E. coli" in <u>Biosensors for Direct Monitoring of Environmental Pollutants in Field</u> (1998) D.P. Nikolelis et.al (eds.) Kluwer Academic Publishers (The Netherlands), pp. 67-77
		Krull, U. et al., "Immobilization of DNA on Optical Surfaces for Development of Biosensors for Pathogens," 81 <sup>st</sup> Canadian Soc. for Chemistry Conf. and Exhibition, Whistler, British Columbia, Canada, (June 1998), Abstract #673
		Krull, U.J., "Investigations of organized monolayer films for biosensor development" 1994 McBryde Medal Award Lecture (1995) Can. J. Chem. 73:1239-1250.
		Krull, U. et al., "Determination of the Average Density of ssDNA on Optical Fiber Biosensors as Prepared by Automated DNA Synthesis," 80 <sup>th</sup> Canadian Soc. for Chemistry Conf. and Exhibition, Windsor, Ontario, Canada, June 1997, Abstract #514
		Krull, U.J. et al., "A Fiber-Optic DNA Biosensor for Salmonella," Pittcon (March 1-5, 1998), p. 4



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Form PTO-1449		
ATTY DOCKET NO. 99-00	SERIAL NO. 09/993,303	FILING DATE November 21, 2001
APPLICANT Piuino		GROUP 1632

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		Krull, U.J. et al., "Immobilization of Single-Stranded DNA for Control of Selectivity, Sensitivity and Response Speed of Hybridization Sensors," Abstract for Gordon Research Conf. on Bio/Analytical Sensors, July 27-August 1, 1997
		Krull, U.J. et al., "Fluorescence Detection of DNA Hybridization on Optical Surfaces for Development of Environmental Biosensors for Pathogens," Pittcon (March 1-5, 1998), p. 1243
		Krull, U.J. et al., "Fiber Optic Chemoreception" in Fiber Optic Chemical Sensors and Biosensors Vol II (1992) Chapter 21 (Wolfbeis, ed.), CRC Press, Boston, pp. 315-340
		Kung, V. T. et al., "Picogram quantitation of total DNA using DNA-binding proteins in a silicon sensor-bases system" (1990) Analytical Biochem. 187:220-227
		Lee, G.U. et al., "Direct Measurement of the Forces Between Complementary Strands of DNA" (November 4, 1994) Science 266:771-773
		Leggett, K., "Laser Fibre Optic Multi-Probe Biosensor," Biophotonics International, (January-February 1997).
		Lesnik et al., "Oligodeoxynucleotides Containing 2'-O-Modified Adenosine: Synthesis and Effects on Stability of DNA:RNA Duplexes" (1993) Biochemistry 32:7832-7838
		Levicky, R. et al., "Using Self-Assembly to Control the Structure of DNA Monolayers on Gold: A Neutron Reflective Study" (1998) J. Am. Chem. Soc. 120:9787-9792
		Love, W.F. et al., "Optical Characteristics of Fiberoptic Evanescent Wave Sensors. Theory and Experiment" (1991) <u>Biosensors with Fiberoptics</u> , Wise and Wingard, (eds.) The Humana Press, Inc., pp. 139-179
		Marshall, E., "Emphasis Turns From Mapping To Large-Scale Sequencing" (June 1995) Science 268:1270-1271
		Maskos, U. and Southern, E.M., "Oligonucleotide hybridisations on glass supports: a novel linker for oligonucleotide synthesis and hybridisation properties of oligonucleotides synthesized <i>in situ</i> " (1992) Nucleic Acids Res. 20(7):1679-1684
		Maskos, U. and Southern, E.M. "A study of oligonucleotide reassociation using large arrays of oligonucleotides synthesized on a glass support." (1993) Nucl. Acids. Res. 21(20):4663-4669
		Meier, C. and Engles, J. W., "Peptide Nucleic Acids (PNAs)--Unusual Properties of Nonionic Oligonucleotide Analogues" (1992) Angew. Chem. Int. Ed. Eng. 31(8):1008-1010
		Millan, K.M. and Mikkelsen, S.R., "Sequence-selective biosensor for DNA based on electroactive hybridization indicators" (1993) Anal. Chem. 65:2317-2323

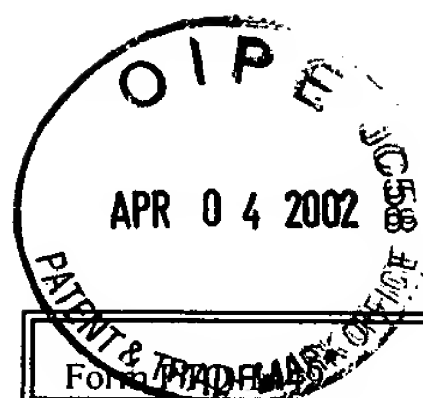


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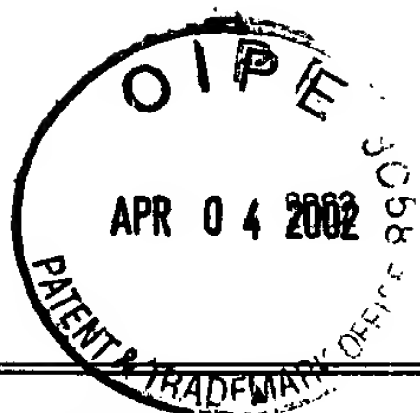
		Millan, K.M. et al., "Voltammetric DNA Biosensor for Cystic Fibrosis Based on a Modified Carbon Paste Electrode" (1994) Anal. Chem. 66:2943-2948
		Nielsen et al., "Peptide nucleic acids (PNAs): Potential anti-sense and anti-gene agents" (1993) Anti-Cancer Drug Design 8:53-63
		O'Donnell, M.J. et al. "High-Density, Covalent Attachment of DNA to Silicon Wafers for Analysis of MALDI-TOF Mass Spectrometry" (July 1997) Anal. Chem. 69(13):2438-2443
		Olson, J.D. et al., "Quantitation of DNA hybridization in a silicon sensor-based system: application to PCR" (1991) Molecular and Cellular Probes 5:351-358
		Piunno, P.A.E., "Development Of A Fibre Optic Biosensor For Determination of Interfacial Nucleic Acid Hybrid Formation" Doctoral Thesis, University of Toronto Nominally released October 2001
		Piunno, P.A.E. and Krull, U.J., "Tethered Dye Gene Probes" (May 1997) Report for Defense Research Establishment Suffield National Defense (Ralston, Alberta, Canada) Report on Department of Supply and Service Contract #W7702-5-R533/01-XSG, Government of Canada Publications
		Piunno, P.A.E. et al., "Consideration for the quantitative Transduction of hybridization of Immobilized DNA" (November 22, 1999) Anal. Chim. Acta.400:73-89
		Piunno, P. et al., "A Fibre-Optic Biosensor for Fluorimetric Nucleic Acid Analysis," 78 <sup>th</sup> Canadian Soc. for Chemistry Conf. and Exhibition, Guelph, Ontario, Canada, June 1995
		Piunno, P. et al., "Fluorimetric Analysis of TAT Triple-Stranded Nucleic Acid Formation Using a Fiber-Optic Biosensor," 14 <sup>th</sup> Annual Graduate Student Symp., SUNY at Buffalo, Buffalo, New York, May 1996.
		Piunno, P. et al., "Fluorimetric Analysis of Double and Triple Stranded Nucleic Acid Sequences Using a Fibre-Optic Biosensor," 79 <sup>th</sup> Canadian Soc. for Chemistry Conf. and Exhibition, St. John's, Newfoundland, Canada, June 1996, Abstract #107
		Piunno, P.A.E. et al., "A Critical Review of Nucleic Acid Biosensor and Chip-Based Oligonucleotide Array Technologies" in <u>Chemical and Biological Sensors for Environmental Monitoring</u> , (December 2000) Mulchandani and Sadik, Eds., ACS Symposium Series 762, ACS Books, Washington, D.C. pp. 257-291
		Piunno, P.A.E. et al., "Fiber-optic DNA sensor for fluorometric Nucleic Acid Determination," (1995) Anal. Chem. 67: 2635-2643
		Piunno, P.A.E. et al., "A fiber optic biosensor for fluorimetric detection of DNA hybridization"(1994) Anal. Chim. Acta 288:205-214





Form PTO-1449		
ATTY DOCKET NO. 99-00	SERIAL NO. 09/993,303	FILING DATE November 21, 2001
APPLICANT Piunno		GROUP 1632

		Piunno, P.A. et al., "A DNA Based Optical Biosensor for Salmonella" Abstract 850 76 <sup>th</sup> CSC Conference Sherbrooke, Quebec (5/30/93-6/3/93)
		Piunno, P. et al., "A DNA Based Optical Biosensor for Salmonella," 76 <sup>th</sup> Canadian Society for Chemistry Conf. and Exhibition, Sherbrooke, Quebec, Canada, June 1993
		Piunno, P. et al., "Fiber-Optic Biosensor for Fluorimetric Nucleic Acid Analysis," 13 <sup>th</sup> Annual Graduate Student Symp., SUNY at Buffalo, Buffalo, New York, USA, May 1995
		Saha, A.K. et al., "1,1'-Carbonylbis(3-methylimidazolium) Triflate: An Efficient Reagent for Aminoacylations" (1989) J. Am. Chem. Soc. 111:4856-4859
		Schena, M. et al., "Parallel human genome analysis: Microarray-based expression monitoring of 1000 genes" (1996) Proc. Nat'l. Acad. Sci. USA 93:10614-106191
		Shchepinov, S.C. et al., "Steric factors influencing hybridisation of nucleic acids to oligonucleotide arrays" (1997) Nucleic Acids Res. 25(6):1155-1161
		Sosnowski, R.G. et al., "Rapid determination of single base mismatch mutations in DNA hybrids by direct electric field control" (1997) Proc. Nat'l. Acad. Sci. USA 94:1119-1123
		Steel, A.B. et al., "Electrochemical Quantitation of DNA Immobilized on Gold" (November 15, 1998) Anal. Chem. 70(22):4670-4677
		Stork, G. and Zhao, K., "A Simple Method of Dethioacetalization" (1989) Tetrahedron Letters 30(3):287-290
		Stowell, M.H.B. et al., "Efficient Synthesis of Photolabile Alkoxy Benzoin Protecting Groups" (1996) Tetrahedron Lett. 37(3):307-310
		Su, H. et al., "Interfacial Nucleic Acid Hybridization Studied by Random Primer <sup>32</sup> P Labeling and Liquid-Phase Acoustic Network Analysis" (1994) Anal. Chem. 66:(6)769-777
		Su, H. et al., "Platinum Anticancer Drug Binding to DNA Detected by Thickness-Shear-Mode Acoustic Wave Sensor" (1995) Anal. Chem. 67:1010-1013
		Su, H. et al., "Network analysis: acoustic energy transmission detection of polynucleotide hybridization at the sensor-liquid interface" (1993) Analyst 118:309-312
		Thompson, R.B. and Ligler, F.S. "Chemistry and Technology of Evanescent Wave Biosensors" (1991) in Biosensors with Fiberoptics, Wise and Wingard (eds.), The Humana Press, Inc., pp 111-138



Form PTO-1449		
ATTY DOCKET NO. 99-00	SERIAL NO. 09/993,303	FILING DATE November 21, 2001
APPLICANT Piunno		GROUP 1632

			Thompson, M. and Furtado, L.M., "High density oligonucleotide and DNA probe arrays for the analysis of target DNA" (August 1999) Analyst 124:1133-1136
			Tombler, E. R. and Deutsch, D. G., "Spectrofluorometric Assay for Hybridization of Oligonucleotides using Ethidium Dimer" (1993) BioTechniques Vol. 15(6):1060-1064
			Towery, R.B. et al., "Genomic DNA Hybridizes with the same rate constant on the QCM biosensor as in homogeneous solution" (January 2001) Biosensors & Bioelectronics 16:1-8
			Uddin, A.H., "Synthesis and Studies on Branched and 2'-5'-Linked Oligonucleotides" Thesis (Ph. D.) McGill University. Made publicly available via the McGill University Library system on June 17, 1997.
			Uddin, A.H. et al., "A fiber optic biosensor for fluorimetric detection of triple-helical DNA" (1997) Nucleic Acids Res. 25(20):4139-4146
			Uhlmann et al., "Oligonucleotide Analogs Containing Dephospho-Internucleoside Linkages" (1993) Protocols for Oligonucleotides and Analogs, Methods in Molecular Biology 20, ed. Sudhir Agarwal, Humana Press, N.J. USA pp 335-389
			Walker, H.W. and Grant, S.B., "Conformation of DNA Block Copolymer Molecules Adsorbed on Latex Particles As Revealed by Hydroxyl Radical Footprinting" (1995) Langmuir 11(10):3772-3777
			Wang, S. et al, "Ultratrace Measurements of Nucleic Acids by Baseline-Corrected Adsorptive Stripping Square-Wave Voltammetry" (May 1999) Anal. Chem. 71:1910-13
			Watterson, J.H. et al., "Controlling the density of nucleic acid oligomers on fiber optic sensors for enhancement of selectivity and sensitivity" (April 15, 2001) Sensors and Actuators B 74:27-36
			Watterson, J.H. et al., "Influences of non-selective interactions of nucleic acids on response rates of nucleic acid fiber optic biosensors" (April 26, 2001) Fresenius J. Anal. Chem. 369:601-608
			Watterson, J.H. et al., "Effects of Oligonucleotide Immobilization Density on Selectivity of Quantitative Transduction of Hybridization of Immobilized DNA" (May 30, 2000) Langmuir 16(11):4984-4992
<b>EXAMINER</b>			<b>DATE CONSIDERED</b>
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